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CORN IN THE GREAT PLAINS AREA: RELATION OF CULTURAL METHODS TO PRODUCTION.

By E. C. Chilcott, *Agriculturist in Charge*, and J. S. Cole and W. W. Burr, *Assistants, Office of Dry-Land Agriculture.*[1]

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INTRODUCTION.

In planning the experimental work of the Office of Dry-Land Agriculture to study methods of crop production under dry-land conditions in the Great Plains, corn was given rather a prominent place. Experience had shown that in the production of fodder it was at least as safe a crop, and perhaps as productive, as any that could be grown in a large part of the area. Experience had also shown that corn growing possessed merit as a preparation of the land for a crop of small grain. When these two factors are combined in one crop they make its growth of double importance. Corn is the only crop at present available that offers this advantage which at the same time lends itself to large acreage and a general farming system.

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[1] All of the members of the scientific staff of the Office of Dry-Land Agriculture have contributed more or less to this paper by having charge of field investigations and by assisting in the preparation of data for records or for publication. The scientific staff as at present constituted consists of the following members, named in the order of length of service: W. W. Burr, Denver, Colo.; E. F. Chilcott, Woodward, Okla.; O. J. Grace, Akron, Colo.; J. S. Cole, Denver, Colo.; J. M. Stephens, Moccasin, Mont.; A. L. Hallsted, Hays, Kans.; O. R. Mathews, Belle Fourche, S. Dak.; J. C. Thysell, Dickinson, N. Dak.; M. Pfaender, Mandan, N. Dak.; H. C. McKinstry, Hettinger, N. Dak.; W. M. Osborn, North Platte, Nebr.; W. D. Griggs, Dalhart, Tex.; C. A. Burmeister, Amarillo, Tex.; J. E. Mundell, Big Springs, Tex.; F. L. Kelso, Ardmore, S. Dak.; W. A. Peterson, Mandan, N. Dak.; J. T. Sarvis, Ardmore, S. Dak.; G. W. Morgan, Huntley, Mont.; J. H. Jacobson, Mitchell, Nebr.; H. G. Smith, Tucumcari, N. Mex.; L. N. Jensen, Woodward, Okla.; J. G. Lill, Garden City, Kans.; R. S. Towle, Edgeley, N. Dak.; A. J. Ogaard, Williston, N. Dak.; C. B. Brown, Dalhart, Tex.; L. D. Willey, Archer, Wyo.; J. B. Kuska, Colby, Kans.; and A. E. Seamans, Akron, Colo.

The following-named men have held positions on the scientific staff of the Office of Dry-Land Agriculture during the past nine years, but have resigned or have been transferred to other offices of the Department of Agriculture: Sylvester Balz, F. L. Kennard, J. E. Payne, L. E. Hazen, C. A. Jensen, H. R. Reed, W. O. Whitcomb, C. H. Plath, F. Knorr, and R. W. Edwards.

The data here reported from the stations in Kansas, Nebraska, North Dakota, and Montana have been obtained in cooperation with the agricultural experiment stations of their respective States. In South Dakota, Colorado, Texas, Oklahoma, and New Mexico the stations are operated by the United States Department of Agriculture.

Field, office, and laboratory facilities, teams, and implements have been provided by the Office of Western Irrigation Agriculture at Huntley, Mont., Belle Fourche, S. Dak., and Mitchell, Nebr., and by the Office of Cereal Investigations at Amarillo, Tex., and Archer, Wyo. The Biophysical Laboratory has cooperated in obtaining the meteorological data reported.

Note.—This bulletin is intended for all who are interested in the agricultural possibilities of the Great Plains area.

The grain sorghums fit equally well into a farming system that includes the production of live stock, but they are not adapted to the whole of the Great Plains, and furthermore have not in general shown an effect so beneficial as corn on the following crop.

Potatoes have approximately the same effect as corn upon most crops that may follow them, but the potato crop does not lend itself so well to growth on a large acreage.

The effect of the growth and clean cultivation of corn as compared with summer tillage and various other methods of preparation has been shown in bulletins simultaneously written on the growth of spring wheat, oats, and barley in the Great Plains area. In these publications it has been shown that the crops following corn have consistently given high yields as compared with other methods of preparing a seed bed for these crops. In many cases the highest yields of small grain have been obtained on disked corn ground. In many other cases where disked corn ground has not been productive of the highest yields, it has so nearly approached them that when the cost of preparation is considered it is found to be productive of the greatest profit. This has attached so much importance to the corn crop that it appears to be desirable to present the actual data on the production of corn in the different years at the different stations and under different methods of cultivation and preparation for the crop.

While corn in most cases has been grown in preparing for other crops and in cropping systems primarily arranged for the growth of other crops, the necessity for studying methods of producing the crop itself has not been overlooked. In general terms, corn has been grown by different methods under a system of continuous cropping. It has been grown at some stations in 2-year rotations of alternate corn and wheat and corn and oats. It has been grown in 3-year rotations where the other two crops were wheat and oats or barley and oats. It has been grown in 4-year rotations with small grains and fallow or the use of green manure. It has also been raised as the second crop from the sod in sod rotations. In some of the rotations manure has been applied before plowing the ground for corn.

Some of the rotations are calculated to conserve or increase the fertility of the soil, while others may perhaps deplete it. In the present stage of the work the effects of the rotations as units are greatly overshadowed by the effects of the cropping and cultivation for a single year. This is due to the fact that the controlling factors are water supply, physical condition of the seed bed, and a certain recognized, although not fully understood, effect of the crop immediately preceding. Uniformity in these factors is largely restored by the cultivation or cropping of a single season. After a careful study of the data, it seemed advisable to present in this bulletin the yields of corn as determined by the cropping and treatment of the land in only the one year immediately preceding the growth of the crop.

In the study that is here made only the more important and obvious results will be discussed. The tables themselves when critically studied show much more than is here mentioned. No attempt is made to study rotations as a whole. There are cumulative effects of rotations and farming systems that are not negligible, but which are not discussed here. Other studies have shown that these effects are of far less immediate importance than the effect of the preceding crop, the preparation of the seed bed, and the seasonal conditions.

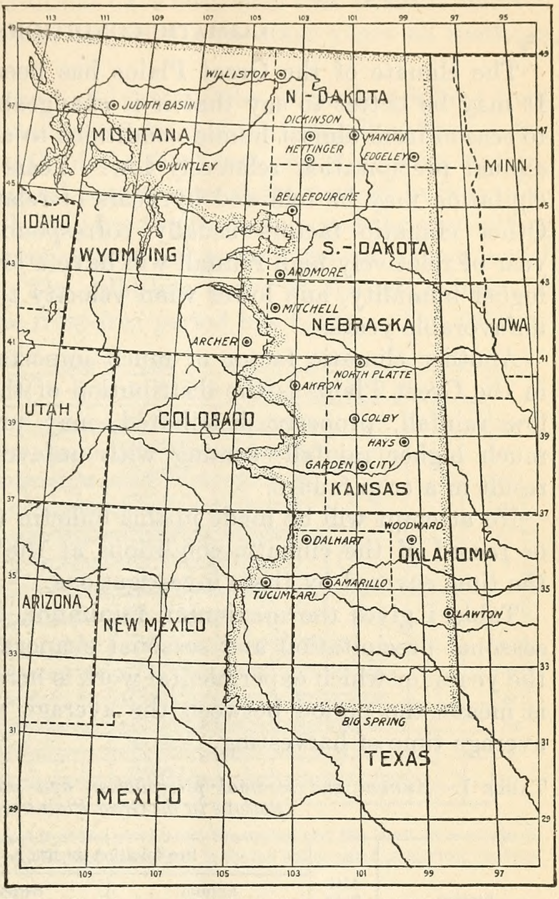

FIG. 1.—Sketch map of the Great Plains area, which includes parts of ten States and consists of about 400,000 square miles of territory. Its western boundary is indicated by the 5,000-foot contour. The location of each field station within the area is shown by a dot within a circle (⊙).

AREA COVERED BY THESE STUDIES.

The area (fig. 1) included in these investigations covers a part of ten States: Montana, North Dakota, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, Texas, and New Mexico· It extends from the ninety-eighth meridian of longitude to the foothills of the Rocky Mountains and from the Canadian border to the thirty-second parallel of latitude.

The altitudes vary from approximately 1,400 feet in the north to 6,000 feet at Cheyenne, Wyo. The southern portion of the territory has a higher average altitude, a higher average rainfall, and a correspondingly higher rate of evaporation than the northern portion.

CLIMATIC CONDITIONS.

The climate of the Great Plains has been classified as semiarid. It may be better to say that it is changeable, varying from season to season from almost humid conditions to almost arid, with a mean annual precipitation relatively low. Years of relatively high precipitation may be followed by years of relatively low precipitation. Other climatic factors usually correspond with the rainfall. A year of relatively high rainfall will have a lower rate of evaporation, higher humidity, and lower wind velocity than will be found in the unfavorable years.

Another climatic factor of much importance in crop production in the Great Plains is the distribution of the rainfall. A relatively low rainfall, properly distributed, may produce a crop where a much higher rainfall, coming with unfavorable distribution, may result in a crop failure.

No attempt will be made in this bulletin to give a full description or record of the climatic conditions at the various stations during the time covered by these investigations.

Table I gives the maximum, minimum, and average annual and seasonal precipitation and seasonal evaporation at each station for the years for which experimental work is here reported. By seasonal is meant the period between the average time of seeding and the average time of harvesting.

TABLE I.—*Annual and seasonal precipitation and seasonal evaporation at fourteen stations in the Great Plains area.*[1]

Station.	Altitude (feet).[2]	Precipitation (inches).[3]						Seasonal evaporation (inches).[3]		
		Annual.			Seasonal.					
		Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.
Judith Basin	4,228	14.96	23.78	18.06	7.04	17.21	9.34	22.012	29.353	24.491
Huntley	3,000	11.92	11.92	11.92	5.92	6.02	5.97	23.754	24.214	23.984
Williston	1,875	10.28	18.99	14.84	4.75	14.49	9.66	20.422	26.877	24.216
Dickinson	2,543	11.93	21.22	16.69	6.85	16.28	9.79	20.673	25.745	23.919
Edgeley	1,468	11.94	21.95	16.71	7.85	14.98	10.11	18.663	24.893	21.866
Hettinger	2,253	12.72	15.68	14.20	8.92	12.47	10.36	21.539	28.239	24.639
Belle Fourche	2,950	6.64	17.73	13.11	4.08	9.78	6.90	26.472	33.750	28.794
Scottsbluff	3,950	13.77	18.51	16.14	2.53	8.52	4.69	23.804	29.381	26.081
North Platte	3,000	11.18	23.01	18.05	6.85	12.66	9.45	28.445	38.168	32.359
Akron	4,600	14.51	22.46	18.28	6.42	13.86	9.02	26.064	35.654	31.420
Hays	2,050	15.59	27.80	21.30	8.18	17.97	11.17	30.625	44.373	35.790
Garden City	2,900	11.82	23.58	18.54	2.79	14.43	8.65	34.325	43.510	38.185
Dalhart	4,000	13.69	16.35	15.11	5.09	9.85	8.01	35.459	41.748	38.988
Amarillo	3,676	10.69	27.80	18.28	6.17	11.38	9.13	33.804	42.076	36.724

[1] The years covered are the same as for the data shown in the other tables for the several stations.

[2] The altitude given is for the field where the work was done and is based in most cases on that of the nearest town.

[3] The records of annual precipitation for 1914 are not included. The records of seasonal precipitation and evaporation for 1914 are included for all stations, being figured from May 1 to Sept. 1. Evaporation measurements are made from a free water surface, in a tank sunk into the soil to almost its full depth. The water surface is kept about level with the surface of the ground.

In these investigations seasonal variations in climatic factors have been of more importance in crop production than differences in methods of tillage. This is shown by the fact that at some stations in some years climatic conditions have been such that all methods have resulted in practical failures in yields. In other years all methods have given fair returns.

Figure 2 shows the earliest and latest dates of the last killing frost in the spring, the earliest and latest dates of the first killing frost in the fall, and the average length of the frost-free period at each station. The heavy hatched horizontal bars represent the periods between the average dates of the last killing frost in the spring and the first killing frost in the fall, or the average frost-free period, the actual number of days being also shown. The solid-line curve at the left shows the earliest date at which the frost-free period has begun. The broken-line curve at the left represents the latest date at which the last killing frost of the spring has occurred. The solid-line curve at the right represents the earliest date and the broken-line curve at the right the latest date at which the first killing frost of the fall has occurred.

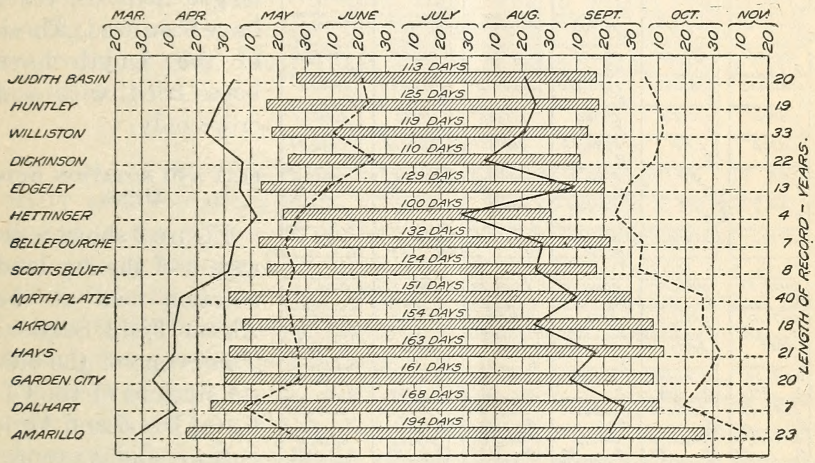

FIG. 2.—Diagram showing the average frost-free periods and the earliest and the latest dates at which the last killing frost in the spring and the first killing frost in the fall has occurred at fourteen stations in the Great Plains area.

This diagram shows clearly the increase in the length of the frost-free period from the north to the south. The shortest average frost-free period is 100 days at Hettinger and the longest one 194 days at Amarillo. The length of the period free from frost is more important in the production of corn than in the production of the small grains. Young corn being easily injured by frost, planting must be delayed until there is little further danger from this source. Where the season is short the crop may be caught by frost in the fall. This necessitates the use of short-season varieties in a portion of the Great Plains. As a season of average length can not be depended on, the production of mature corn has been so uncertain at some stations as to make the crop unprofitable if grown for grain alone.

GENERAL PLAN OF THE INVESTIGATIONS.

The method of work adopted in these investigations involved the raising of different crops in various combinations or systems of rotations and under different methods of cultivation in systems of continuous cropping. Most of the work has been done with 3-year and 4-year rotations. No rotations of greater length than six years have been used. Those of this length have been tried with sod crops only.

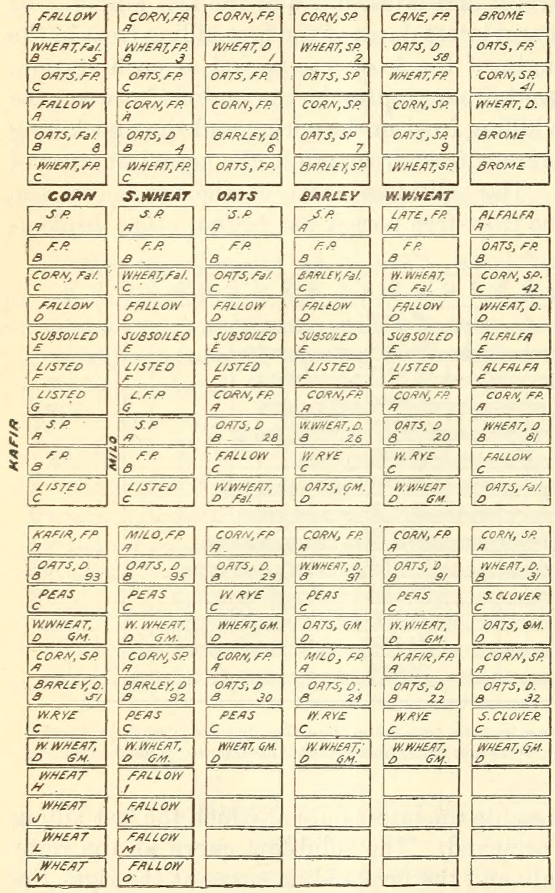

FIG. 3.—Diagram of the dry-land rotation field at the Akron Field Station. The lettering shows the cropping practiced in 1914. The explanation of abbreviations used is as follows: *D.*=Disked, *Fal.*=summer tilled, *FP.*=fall plowed, *GM.*=green manured, *L.*=listed, *M.*=manured, *S.*=spring plowed, *SS.*=subsoiled.

PLAT AND ROTATION OUTLINES.

Figure 3 shows a diagram of the dry-land rotation field at the Akron Field Station. This is one of the oldest stations of the Office of Dry-Land Agriculture, and is a representative one that will serve to illustrate the general scheme and plan of work. The plats involved in the work at this station and at all of the stations are one-tenth of an acre in size. Their dimensions are 2 by 8 rods. Along their larger dimension the plats are separated by alleys 4 feet wide. Along the ends of the plats they are separated by roads 20 feet wide. At all of the stations five crops are represented in a series of continuously cropped plats, lettered on the diagram from A to G. In this group C and D are alternately cropped and summer tilled so that each year a crop is grown after summer tillage and a plat is summer tilled for cropping the next year. The remainder of the field is in rotations in which each plat is known by a rotation number and letter. On the field diagram the separation of rotations is indicated by heavy lines. The movement of the crops in the rotation is from Z to A, and from A back to the letter that marks the other end of the rotation.

In figure 3 the diagram is filled out to show the cropping in 1914. The letters following the crop indicate the treatment given the ground in preparation for the crop: SP. stands for spring plowed, FP. for fall plowed, Fal. for summer tilled, GM. for green manured, D. for disked, etc.

As an illustration, rotation 14 may be used: In 1914, plat A of this 4-year rotation was planted to corn on spring-plowed ground, B was in wheat on disked corn ground, and C was in winter rye after fall plowing. Plat D was in oats where winter rye had been turned under the preceding year. In 1915, A will be in wheat, B in winter rye, C in oats, and D in corn.

VARIETIES.

In these investigations no attempt was made to grow the same variety at different stations. The aim was to select a variety well adapted to the conditions of the station where it was grown. The same variety has not been grown at any station during the entire period of the investigations. When a variety was obtained that was thought to be better adapted to local conditions than the one previously grown, a change was made.

At most of the stations, early-maturing varieties have been used. In the northern part of the area the growing season is so short that only very early varieties are at all safe. Increasing altitude with its correspondingly cooler nights, or decreasing water supply, has much the same effect as increasing latitude. At Hays, North Platte, and Amarillo varieties are grown that are somewhat larger and later maturing than those grown at the other stations.

DETERMINATION OF YIELDS.

The corn is harvested either when mature or when growth is stopped by frost. It is cut with a binder and shocked in the field. The shocks stand until cured, usually about a month. They are then weighed and the sound corn, if any, is husked and weighed. Where sound corn is produced, the yield as tabulated is given in bushels in the column headed "Grain." The column headed "Stover"[1] shows the total weight when no grain is produced and the difference between the weight of the grain and the total weight when corn is husked. The grain weights are converted into bushels on the basis of 70 to 75 pounds per bushel, depending upon the dryness at the time of husking.

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[1] In the tables of this bulletin only the term "stover" is used, because the corn was husked whenever marketable or whenever it was produced in sufficient quantity to warrant husking. In cases where the yield of grain was not sufficient to warrant husking the term "fodder" would be more exact.

In some cases when the crop did not dry out or cure well the weights have been arbitrarily reduced by the percentage estimated or determined to be necessary to bring them to normal air dryness. Only occasionally is it necessary to do this in the Great Plains area.

SEEDING AND STAND.

The time of planting corn at the various stations is more uniform than the time of seeding the small grains. Small grains are usually seeded as early as the season will permit in the southern as well as in the northern portion of the area. This is done because the small grain will withstand the cooler weather of the early spring and may be able to mature in advance of drought which so frequently occurs at about harvest time. Corn, on the other hand, requires warm weather and a warm soil. In the southern portion of the territory, therefore, where the growing season is longer, the usual practice is to wait for the soil to become warm, thus delaying the planting. In the northern part of the territory the season is so short that the planting can not be delayed, and the planting season is advanced to the limit of safety. This delay in the southern part and advancement in the northern part tends to equalize the time of planting throughout the territory. In the southern part of the territory the usual date of planting is May 10 to 15; in the northern part, May 25 to June 1, a difference of about two weeks.

At North Platte all the corn included in these studies was planted with a lister. At all of the other stations the corn is surface planted in rows, with the exception of one or two listed plats at each station. To insure a uniform stand, the corn is planted thicker than it is intended to grow and then thinned to the desired stand. This may in some cases interfere with differences in stand that might result from differences in seed bed, but it appears to be the only practicable way to handle the crop in experimental work where it is desired to eliminate as many variable factors as possible.

The thickness of the stand of corn that is finally established at the various stations depends upon the amount of water which past experience has shown may be expected during the growing season and upon the expectation of producing grain. At the Judith Basin Field Station the corn is thinned to a distance of 9 inches between the plants. At this station there is enough available water to maintain a thick stand, but the growing season is so short that grain is not matured. At the stations where the amount of available water is less and the growing season longer, the distance between the plants is increased until in some cases it is as much as 24 inches. It seems possible that this distance should be made still greater at some of the stations.

SEED-BED PREPARATION.

The results from different methods have been tabulated and are here presented in such a manner as to show the effect of the cropping or cultivation and preparation of the land in the one year prior to the corn planting. The tables show the effect of plowing for corn both in the spring and in the fall and after both corn and small grain, the effects of listing and of subsoiling where these have been tried, and the effect of summer tillage.

In the tables as presented, the yields reported in the columns headed "Spring plowed, after corn" are from plat A, continuously cropped to corn. This plat is shallow spring plowed and is given a minimum of cultivation.

The yields reported in the columns headed "Fall plowed, after corn" are from plats continuously cropped to corn under a system of fall plowing and cultivation for the conservation of water both in the fall and in the spring. Fall plowing is done as early as practicable. It is done to a good depth, the standard being set at 8 inches. The ground after plowing may be worked down or left rough through the winter, as seems advisable. This plat at each station is generally known in this work as continuous-corn plat B.

The yields reported after summer tillage are from two plats alternately summer tilled and cropped to corn. One of the pair is in corn and the other is summer tilled each year. These are the plats generally known as C and D in the continuous-corn series. Summer tillage is of the intensive type. The land lies fallow one year and until planting time the following year. In so far as it is practicable to do so the plat is kept free from weeds and a mulch is maintained on it during the period between the time of harvesting the preceding crop and the time of planting the corn. This period in some cases is as long as 18 months. In some cases it is necessary to plow the land more than once during this period, either to maintain a surface receptive to water and that will resist blowing or to prevent the growth of weeds. The long period of summer tillage, involving the nonproduction of a crop for one year, together with the intensive methods practiced, have made this an expensive system of treatment.

The subsoiled plat is continuously cropped to corn. It is handled the same as plat B except that at the time of plowing it is subsoiled. A depth of about 14 inches is usually reached. Where the history of the station is sufficiently long for it to have been accomplished, it has been subsoiled two years in succession. Subsoiling was then suspended for two years and then resumed. The plat is known as E in the continuous-corn series.

The yields reported in the column headed "Listed" are also from land continuously cropped to corn. Where the yield reported is from one plat only, it is from a plat that receives no cultivation before planting with the lister. Where it is given as an average of two plats, one is disked and cultivated during the spring before planting. All the other yields are from corn in rotations with other crops, as designated.

No attempt is made in this bulletin to discuss the various types of soils at the different stations. The yields show that the soils at some stations offer very little, if any, response to differences in tillage methods, while other soils do respond to tillage, the response varying from year to year with the varying combinations of climatic factors. A brief discussion of the soils at the different stations is given in a bulletin simultaneously prepared (Bulletin 214 of the department series) entitled "Spring wheat in the Great Plains area: Relation of cultural methods to production."

COMPARISON OF CULTURAL METHODS.

The methods under study vary a great deal in the labor involved and in the consequent cost of production. An accurate record has been kept of all farm operations performed in pursuance of the various methods under trial. These records have been averaged for eight representative stations having the longest period of trial. It is recognized that this average does not exactly represent the requirements of any station. The amount of work required for some methods varies with the season and with the soil. While recognizing this, it seems more practicable to use a fixed basis for all the stations than to try to adjust the cost for each station separately.

Table IV gives in the columns headed "Number of operations" the average number of times each of the separate operations have been performed in growing the crop. The amount of labor performed under each of the methods was neither more nor less than that which the man in charge believed to be necessary.

In practice it is probable that much of the corn produced in the dry-farming section will be either siloed or fed in the bundle rather than shelled and sold on the market. The cost of production therefore has been computed for the corn in the shock.

In computing the costs of the various operations a fixed wage of $2 a day for a man and $1 a day for a horse was adopted. This may be above or below the actual labor cost in any particular locality, but it is believed to be a fair average and one that will afford a profitable market to the farmer for his labor. The time required for men and teams to cover a given acreage in the several farm operations obviously varies with soils and other conditions. The average shown in Table II has been determined from the actual experience of a large number of men connected with these investigations—experience that has extended over a wide range of conditions and many years of time.

The factors included in the cost of production are calculated on an acre basis for each of the separate operations performed, beginning with the preparation of the land and ending with the harvesting and shocking of the crop. To these items are added the cost of seed, at 22 cents per acre; interest and taxes on the land investment, calculated at 8 per cent on a valuation of $20 per acre; and the deterioration and repairs of the binder, at 15 cents per acre. No allowance is made for the deterioration of other farm equipment, as it is believed that the wages assigned for men and teams are sufficient to cover this item of expense.

Table II.—*Average cost per acre of the farm operations involved in growing corn in the Great Plains area.*

[The wage scale assumed is $2 per day for each man and $1 per day for each horse.]

Operation.	Force employed.		Day's work.	Item cost.	Cost per acre.
	Men.	Horses.			
			Acres.		
Plowing	1	4	3½		$1.71
Disking	1	4	8		.75
Harrowing	1	4	35		.17
Subsoiling	1	3	3½		1.43
Drilling	1	4	15		.40
Cultivating	1	4	16		.38
Listing	1	4	10		.60
Harvesting:					
Cutting and binding	1	3	8	$0.62½	1.50
Shocking	2			.50	
Twine				.22½	
Binder wear and repair				.15	

Table II shows the cost per acre, based upon what is considered an average day's work for each of the farm operations involved, at the above-mentioned wage. The cost of production as computed in Tables II and IV is not offered as being absolute for any locality, either in the amount of labor required or its cost. It is recognized that the labor cost will vary with individuality and conditions. The cost of twine to bind an acre of corn obviously varies with the character of the crop. The assumed land value would be too low for many sections of the Plains. The estimated cost used in the table would be low for even an average crop in sections where heavy yields are obtained. Recognizing these and other possible variations, the cost shown in the tables is used simply to give a working basis for the comparison of the results by different methods.

VALUATION OF THE CROP.

The average farm price of corn on December 1 for 10 years is given in Table III. These data were furnished by the Bureau of Crop Estimates. The four States of North Dakota, South Dakota, Nebraska, and Kansas were selected as representative of the most stable market conditions within the area included in these investigations. This table shows that the average farm price of corn on December 1 in the four States has been 51 cents per bushel for the period considered.

TABLE III.—*Average price of corn at the farm bin for 10 years in four States of the Great Plains area.*

[The quotations are given in cents per bushel. Those for the year 1914 are for the date of Nov. 1; in other years Dec. 1 is taken as the date.]

Year.	North Dakota.	South Dakota.	Nebraska.	Kansas.	Average.	Year.	North Dakota.	South Dakota.	Nebraska.	Kansas.	Average.
1905	36	31	32	33	33	1911	60	53	55	63	57¾
1906	39	29	29	32	32¼	1912	43	37	37	40	39¼
1907	60	46	41	44	47¾	1913	52	56	65	78	62¾
1908	60	50	51	55	54	1914	60	56	60	70	61½
1909	55	50	50	54	52¼						
1910	58	40	36	45	44¾	Average.	52	45	46	61	51

The value of corn fodder or stover is difficult to estimate. The average farm price of hay in North Dakota, South Dakota, Nebraska, and Kansas on December 1 for the 10 years ended 1913 has been $6.22 per ton. Very few feeding experiments are available from which to determine the relative values of corn fodder and hay. As a matter of experience and observation and from the best evidence obtainable, it is believed that corn stover of the quality produced in the dry-farming sections is worth at least two-thirds as much as hay. This is admittedly an estimate. The stover produced in the area covered by this bulletin varies widely in quality. In some cases it is either immature corn or corn that failed to produce ears. In those localities where marketable corn has been produced it is that portion of the crop remaining after the grain has been husked. For the sake of uniformity in the tables the designation "Stover" is used in all cases.

Under the heading "Total cost of production," in Table IV, the costs are computed as fixed charges per acre for the crop in the shock. Values are computed on the basis of $4 per ton for the fodder or stover and 40 cents per bushel for the corn in the shock. The average farm price of corn for the past 10 years as shown in Table III has been 51 cents per bushel in the bin. The use of the price of 40 cents in the shock allows 11 cents per bushel for husking, shelling, and putting the corn in the bin. It is believed that this is a liberal allowance.

TABLE IV.—*Comparative cost per acre of producing corn by different methods.*[1]

[Averages of data from eight stations.]

Method of preparation.	Number of operations.				Cost of preparation.	Cost per acre.					Total cost of production.		
	Plowing.	Harrowing.	Disking.	Subsoiling.		Seed.	Planting.	Cultivation.[2]	Harvesting.	Interest and taxes.	In dollars.	In fodder at $4 per ton.	In grain at 40 cents per bushel.
Listed	......	1	1	......	$0.92	$0.22	$0.60	$1.14	$1.50	$1.60	5.98	1.50	15
Spring plowed	1	1.4	.6	......	2.40	.22	.25	1.14	1.50	1.60	7.11	1.78	17.8
Fall plowed	1	1.4	1.1	......	2.78	.22	.25	1.14	1.50	1.60	7.49	1.87	18.7
Subsoiled	1	1.4	1.1	0.5	3.47	.22	.25	1.14	1.50	1.60	8.18	2.05	20.5
Summer tilled	1.4	8.3	3	......	6.05	.22	.25	1.14	1.50	3.20	12.36	3.09	30.9

[1] This cost does not include an estimate of the cost of husking and cribbing.
[2] The cost of cultivation is based on three cultivations.

RESULTS AT INDIVIDUAL STATIONS.

Tables V to XVII, inclusive, present for each station the results of different methods of seed-bed preparation for corn. Each table presents the results for a single station. Except at stations where no grain was produced, the yields of both grain and stover by each of the methods studied are given for each year. The average yield of both grain and stover is also given for the entire period of years under study. The value of each of these is computed separately and shown. In the line designated "Total value" the combined value of both grain and stover is given. In the line designated "Cost" is given for each method of tillage the cost of production as determined in accordance with the explanation already made. In the last line of the table is given the profit or loss by each method as shown by the foregoing determinations. This is not given as being absolute, but is shown as a basis for the comparison of different methods of producing the corn crop and for comparing the production of corn with other crops.

JUDITH BASIN FIELD STATION.

During the five years covered by the records of the field station at Moccasin, Mont., in the Judith Basin, good average yields of corn fodder have been produced. No marketable grain has been obtained. The season is so short, and at this altitude so much cool weather prevails, that corn does not ordinarily reach maturity. The growing of corn at this station is to be considered, therefore, from the standpoint of the production of fodder rather than of grain. Its value lies in the possibility of increasing the number of live stock kept on the farm rather than in its production as a cash market crop. The corn at this station does not grow tall and coarse. It is so short that it can be harvested with a grain binder, and it has a large proportion of leaves to the stalk, so that it makes excellent feed.

A careful study of the yields in Table V shows that the seasonal influence is much greater than the influence of tillage. This is brought out by the wide variation in average yields in different years and the much smaller variation in the yields from different methods within the same year.

Good or heavy average yields of fodder are shown by all methods, but little consistent advantage of one method over another. The lack of consistent differences in yield by various methods of tillage indicates that this soil offers little response to any particular method of seed-bed preparation for corn. This lack of response is doubtless due to the shallowness of the soil, and has been found true thus far for the spring-sown small grains, as well as for corn. Perhaps the chief thing to be noted in the yields is that corn has averaged somewhat better after corn than after small grain. Summer tillage has been productive of yields intermediate between the two.

TABLE V.—*Yields and cost of production of corn by different methods at the Judith Basin Field Station, 1909 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.		Spring plowed.		Subsoiled, after corn (1 plat).	Listed, after corn (1 plat).	Summer tilled (1 plat).
	After corn (1 plat).	After small grain (9 plats).	After corn (1 plat).	After small grain (16 plats).			
Yields of stover:							
1909 pounds	11,120	10,011	10,100	8,603	11,420	11,700	11,530
1910 do	2,900	2,385	2,760	2,626	3,650	3,260	3,300
1911 do	7,000	6,174	7,250	5,895	4,780	6,700	3,850
1912	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1913 pounds	4,000	3,683	5,000	4,227	5,800	4,450	6,100
1914 do	3,700	4,122	4,900	4,500	5,000	3,800	3,500
Average	5,744	5,275	6,002	5,193	6,130	5,982	5,656
Value	$11.49	$10.55	$12.00	$10.39	$12.26	$11.96	$11.31
Cost	7.49	7.49	7.11	7.11	8.18	5.98	12.36
Profit or loss	4.00	3.06	4.89	3.28	4.08	5.98	−1.05

[1] The crop in 1912 was partially destroyed by hail. Some corn was produced, but the lack of uniformity in the yields makes it inadvisable to use the results in this table.

All methods except summer tillage have been productive of profitable crops. The greatest profit, $5.98 per acre, has been by the least expensive method—listing. The next largest profit, $4.89 per acre, has been by spring plowing after corn. Excluding summer tillage, the small difference in the net results by different methods indicates that the problem is one of utilization of the feed rather than of the method of its production.

HUNTLEY FIELD STATION.

The results of two years at Huntley, Mont., are shown in Table VI. In both years good crops of grain were produced. With the exception of subsoiling, the relative performance of different methods is quite consistent. In 1914 the subsoiled ground apparently lacked water to mature its crop. Greater differences have been manifested in the yields of grain than in those of stover.

TABLE VI.—*Yields and cost of production of corn by different methods at the Huntley Field Station in 1913 and 1914.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Subsoiled, after corn (1 plat).		Listed, after corn (1 plat).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (6 plats).		After corn (1 plat).		After small grain (16 plats).							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1913	14.8	1.400	19.6	1,350	24.4	1,250	28.8	1,553	25.7	2,300	30.1	1,300	27.2	1,900
1914	13.2	1,360	19.2	1,643	19.2	1,500	22.9	1,707	13.9	1,590	22.5	1,910	25.0	1,490
Average	14.0	1,380	19.4	1,497	21.8	1,375	25.2	1,654	19.8	1,945	26.3	1,605	26.1	1,695
Value	$5.60	$2.76	$7.76	$2.99	$8.72	$2.75	$10.08	$3.31	$7.92	$3.89	$10.52	$3.21	$10.44	$3.39
Total value	$8.36		$10.75		$11.47		$13.39		$11.81		$13.73		$13.83	
Cost	7.49		7.49		7.11		7.11		8.18		5.98		12.36	
Profit	.87		3.26		4.36		6.28		3.63		7.75		1.47	

Particularly in the production of grain, spring plowing has been markedly better than fall plowing. After both fall and spring plowing the yield has been better following small grain than following corn. Subsoiling for this crop has been done only on ground continuously cropped to corn. The yield by this method in 1914 was the lowest of any except by the fall plowing of similar ground.

Slightly higher yields than by any other method have been obtained by listing on ground continuously cropped to corn. Corn following summer tillage has been productive of crops practically equal to those on listed corn ground. On the whole, there is little choice to be made from so short a record between the yields on summer-tilled land, listed corn ground, and spring-plowed grain stubble.

Profits ranging from 87 cents (by fall plowing after corn and $1.47 by summer tillage) to $6.28 (by spring plowing after small grains and $7.75 by listing after corn) have been realized. All methods except fall plowing after corn, subsoiling after corn, and summer tillage have shown a profit from the grain crop alone.

WILLISTON FIELD STATION.

The results of five years at Williston, N. Dak., are available for study and are shown in Table VII. In only two of these years has mature corn been produced. In each of these years the yield has been very good. The yields of stover in 1912 are exceptionally high—

much higher than the stand and height would indicate. It has been impossible, however, to detect any error in the computations.

TABLE VII.—*Yields and cost of production of corn by different methods at the Williston Field Station, 1910 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (4 plats).		After corn (1 plat).		After small grain(12 plats).			
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1910	....	1,440	....	1,770	....	1,560	....	1,617	....	4,540
1911	....	3,040	....	3,404	....	3,560	....	4,200	....	4,660
1912	....	11,600	....	18,235	....	13,500	....	16,010	....	9,420
1913	38.3	7,230	14.7	7,608	31.5	6,470	25.7	6,322	45.2	7,280
1914	38.4	4,400	49.1	4,698	43.9	3,810	44.6	4,536	42.8	3,720
Average	15.3	5,542	12.8	7,143	15.1	5,780	14.1	6,537	17.6	5,924
Value	$6.12	$11.08	$5.12	$14.29	$6.04	$11.56	$5.64	$13.07	$7.04	$11.85
Total value	$17.20		$19.41		$17.60		$18.71		$18.89	
Cost	7.49		7.49		7.11		7.11		12.36	
Profit	9.71		11.92		10.49		11.60		6.53	

There is a lack of consistent differences in the production by different methods from year to year and of any wide variation in the average results for the whole period of years. Marked responses to cultural conditions indicated in certain seasons are balanced by different reactions in other seasons. If no marked benefit attends the use of any method, greater freedom is left in the choice of methods.

With the values of grain and fodder and the comparative cost of production as here computed, the corn crop shows a profit by all methods under which it has been grown. The least profit, $6.53 per acre, has been from summer-tilled land. Greater profits have been realized from corn after small grain than from corn after corn. Only small differences are exhibited in the profits realized by fall plowing and spring plowing.

A study of other crops at this station has shown them to be more responsive than corn to differences in cultural conditions. The place of corn in the rotation should therefore be subordinated to the interest of the other crops.

The comparatively small-growing varieties of corn which are planted in this section produce a high percentage of leaves, which give a high value to the fodder. When grain is produced it makes the feed all the more valuable. The production of a large supply of good feed per acre, together with the fact shown in other studies that corn is one of the best crops to precede small grain, should give this crop an important place in the farm economy of this section.

DICKINSON FIELD STATION.

Table VIII shows the results of a study of the production of corn at Dickinson, N. Dak., for six years, exclusive of 1912, when the crop was destroyed by hail. Four of these years were productive of grain, but in the other two years fodder only was produced.

TABLE VIII.— *Yields and cost of production of corn by different methods at the Dickinson Field Station, 1908 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (4 plats).		After corn (1 plat).		After small grain (16 plats).			
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*
1908	....	1,660	....	2,247	....	2,000	....	2,787	....	1,070
1909	52.4	2,000	49.5	2,005	58.4	2,280	49.7	2,156	45.2	1,710
1910	26.1	2,220	22.8	1,790	26.2	2,280	22.2	1,948	8.4	1,220
1911	....	4,500	....	3,225	....	4,300	....	4,195	....	4,800
1912	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1913	27.9	1,050	33.1	2,100	28.2	2,110	26.3	1,575	26.3	1,230
1914	12.7	1,200	18.2	1,495	15.9	1,200	20.6	1,788	7.3	900
Average	19.9	2,105	20.6	2,144	21.5	2,362	19.8	2,408	14.5	1,822
Value	$7.96	$4.21	$8.24	$4.29	$8.60	$4.72	$7.92	$4.82	$5.80	$3.64
Total value	$12.17		$12.53		$13.32		$12.74		$9.44	
Cost	7.49		7.49		7.11		7.11		12.36	
Profit or loss	4.68		5.04		6.21		5.63		−2.92	

[1] Destroyed by hail.

The point most emphasized in a comparison of the yields by different methods is the decreased production attending the growth of corn on summer-tilled land. The only year when yields by summer tillage have compared favorably with those by other methods was in 1911. This was the driest year in the series shown. Corn has not generally suffered from a lack of water at this station. No significance attaches to the small differences to be noted between the yields of corn following corn and of corn following small grains.

By all methods except summer tillage the grain crop alone has been sufficient to afford a small profit. On summer-tilled land the crop has been grown at an average loss of $2.92 when the value of both grain and stover is considered. In the average of the six years under study, spring plowing has given somewhat better returns than fall plowing. The difference is not great enough, however, to be of much practical importance.

EDGELEY FIELD STATION.

The results of eight years at Edgeley, N. Dak., are presented in Table IX. In three of these years mature grain has been produced. In two other years there were prospects for a good crop of grain, but it did not mature. In the other three years but few ears set and the yield was chiefly stover.

TABLE IX.—*Yields and cost of production of corn by different methods at the Edgeley Field Station, 1907 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (5 plats).		After corn (1 plat).		After small grain (20 plats).			
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*
1907	0	2,850	0	3,200	0	1,550	0	2,261	0	1,150
1908	0	2,300	0	2,150	0	2,250	0	1,973	0	1,500
1909	33.3	2,350	29.8	2,750	37.4	2,650	29.7	3,025	36.5	2,050
1910	0	2,100	0	1,250	0	1,650	0	1,661	0	1,850
1911	0	4,750	0	4,730	0	4,400	0	4,572	0	5,500
1912	0	6,250	0	6,040	0	7,300	0	6,382	0	6,500
1913	19.4	2,100	19.6	2,486	16.0	2,850	21.8	2,965	14.1	1,850
1914	3.6	1,610	16.5	3,004	5.1	2,380	15.9	3,117	3.9	3,010
Average	7.0	3,039	8.2	3,201	7.3	3,129	8.4	3,245	6.8	2,926
Value	$2.80	$6.07	$3.28	$6.40	$2.92	$6.26	$3.36	$6.49	$2.72	$5.85
Total value	$8.87		$9.68		$9.18		$9.85		$8.57	
Cost	7.49		7.49		7.11		7.11		12.36	
Profit or loss	1.38		2.19		2.07		2.74		−3.79	

On the whole, only small differences are exhibited in the yields from different methods of preparation for the corn crop. There is a slight advantage in favor of spring plowing over fall plowing on both corn ground and small-grain stubble. The yields of both grain and stover were somewhat better when the corn followed small grain than when it followed corn. The relative response to these sequences was the same on both fall and spring plowing.

The four preparations for corn—fall and spring plowing following corn and fall and spring plowing following small grain—rank in order of yield obtained as follows: (1) Spring plowing on small-grain stubble, (2) fall plowing on small-grain stubble, (3) spring plowing on corn ground, and (4) fall plowing on corn ground. Average profits ranging from $1.38 to $2.74 per acre have been realized by these methods. The difference exhibited in the results attending the use of these methods is not great enough to be in itself a determining factor in the choice of rotations or in the management of the farm and its work. Summer tillage as a preparation for corn has given poorer results than any other method. In only one year has it been productive of the largest crop. The average yield of both grain and stover by this method is less than by any other method under study. The value of the average corn crop on summer-tilled land has been $3.79 per acre less than the cost of its production as crop values and comparative costs are here computed.

BELLE FOURCHE FIELD STATION.

Table X presents the results of the work of six years with corn in rotations and under varying tillage methods at Belle Fourche, S. Dak. In one year, 1911, extreme drought caused a failure of all methods under trial. In three of the six years grain was produced by all methods. In the other two years all methods produced fodder, but grain was produced only upon land which was summer tilled the previous year.

TABLE X.—*Yields and cost of production of corn by different methods at the Belle Fourche Field Station, 1909 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Sub-soiled, after corn (1 plat).		Listed, after corn (1 plat).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (4 plats).		After corn (1 plat).		After small grain (17 plats).							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1909	23.5	5,310	19.4	3,365	24.4	4,560	18.3	2,891	20.8	4,000	24.8	4,575	20.8	4,860
1910	0	2,760	0	1,705	0	3,560	.1	3,014	0	3,140	0	3,800	14.8	2,500
1911	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1912	29.7	3,250	21.7	2,875	26.4	2,700	20.2	2,515	26.3	3,100	27.5	2,150	28.4	2,750
1913	6.5	1,060	7.8	985	7.8	900	8.0	995	9.4	1,060	9.7	800	23.6	960
1914	0	1,350	0	1,000	0	1,150	0	1,035	0	1,450	0	1,450	14.2	2,000
Average	10.0	2,288	8.1	1,655	9.8	2,145	7.8	1,742	9.4	2,125	10.3	2,129	17.0	2,178
Value	$4.00	$4.58	$3.24	$3.31	$3.92	$4.29	$3.12	$3.48	$3.76	$4.25	$4.12	$4.26	$6.80	$4.36
Total value	$8.58		$6.55		$8.21		$6.60		$8.01		$8.38		$11.16	
Cost	7.49		7.49		7.11		7.11		8.18		5.98		12.36	
Profit or loss	1.09		— .94		1.10		— .51		— .17		2.40		—1.20	

Corn after corn produced more grain and more stover than corn after small grain. Little difference is shown in the yields by spring plowing and by fall plowing. Each of these methods has been tried after both corn and small grain.

Subsoiling was practiced on land continuously cropped to corn. It produced yields practically the same as similarly cropped land plowed either in the spring or fall without subsoiling.

Planting with the lister on land continuously cropped to corn produced yields practically the same as those from corn ground plowed and surface planted.

The highest average yield of grain has been from land summer tilled the previous year. The increase in the average comes chiefly from the grain produced in 1910 and 1914, when other methods failed, and to its increase of yield over other methods in 1913. The yield of stover from this method does not show an increase over that following the several methods by which corn is grown following corn.

Neither the average grain crop nor the average stover crop alone by any method under trial has been sufficient to pay the cost of producing it. When both are considered together, the crop shows for all methods variations ranging from a loss of $1.20 on summer-tilled land to a profit of $2.40 on listed corn ground. Both spring and fall plowing after corn show profits of more than a dollar an acre. Fall and spring plowing following small grains and subsoiling following corn all show losses of less than a dollar per acre. In general terms, the corn crop at this place has just about paid the expense of its production, including something for the use of the land. The greatest crop assurance has been by summer tillage, but the cost of the method has resulted in a small loss from its use.

SCOTTSBLUFF FIELD STATION.

Some of the results of the work for three years with corn at Scottsbluff, Nebr., are presented in Table XI. The production of both grain and fodder was good each year. The value of the grain crop alone was sufficient to realize a profit by all methods under trial.

TABLE XI.—*Yields and cost of production of corn by different methods at the Scottsbluff Field Station, in 1912, 1913, and 1914.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Subsoiled, after corn (1 plat).		Listed, after corn (1 plat).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (9 plats).		After corn (1 plat).		After small grain (20 plats).							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1912	38.0	2,400	36.2	4,406	40.8	3,300	40.7	4,770	40.0	4,300	21.6	2,900	49.7	5,600
1913	32.2	1,660	26.4	2,148	27.8	1,740	31.4	2,550	26.1	1,700	38.6	1,700	35.6	2,600
1914	20.1	1,200	11.0	994	15.0	700	7.5	1,020	14.2	840	14.6	620	31.7	1,400
Average	30.1	1,753	24.5	2,516	27.9	1,913	27.5	2,770	26.8	2,280	24.9	1,740	39.0	3,200
Value	$12.04	$3.51	$9.80	$5.03	$11.16	$3.83	$11.00	$5.54	$10.72	$4.56	$9.96	$3.48	$15.60	$6.40
Total value	$15.55		$14.83		$14.99		$16.54		$15.28		$13.44		$22.00	
Cost	7.49		7.49		7.11		7.11		8.18		5.98		12.36	
Profit	8.06		7.34		7.88		9.43		7.10		7.46		9.64	

The only method of preparation that in any year produced a yield of either grain or stover greater than that from summer-tilled land was that of listing corn ground in 1913. Methods other than summer tillage do not exhibit sufficient consistent differences in yield to warrant very definite conclusions as to their comparative merits. The lack of consistency is shown in the comparative yields of both grain and stover. Some of the methods producing the best yields of grain have been among the lowest in yield of stover and vice versa.

No one of the six methods other than summer tillage maintained a position as either the best or poorest throughout the three years.

The greatest profit, $9.64 per acre, was from corn on land that was summer tilled the preceding year. A profit nearly as great, $9.43 per acre, was realized from corn by spring plowing following small grain. An average profit of $8.06 per acre was realized from corn following corn by fall plowing. Subsoiling after corn, fall plowing after small grain, listing after corn, and spring plowing after corn show profits ranging from $7.10 to $7.88 per acre.

NORTH PLATTE FIELD STATION.

The results of eight years are available for study from the field station at North Platte, Nebr. A study of Table XII shows that this station has produced four good crops of corn. In two other years the average yields were low, but good yields were produced by some methods. In the remaining two years some corn was produced but not enough to warrant husking. The average for eight years shows that there is very little choice to be made between fall and spring plowing, nor were wide differences manifested in the results by these methods in any of the years comprising the series.

TABLE XII.—*Yields and cost of production of corn by different methods at the North Platte Field Station, 1907 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (9 plats).		After corn (1 plat).		After small grain (9 plats).			
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*	*Bush.*	*Lbs.*
1907	27.7	4,360	19.0	4,529	28.7	4,680	19.9	4,609	17.9	4,920
1908	24.6	2,660	27.4	3,143	38.6	3,250	24.0	3,463	38.2	3,530
1909	31.6	2,790	26.1	2,354	29.0	2,470	25.8	2,613	25.0	2,300
1910	6.2	2,500	2.6	1,200	8.9	2,440	5.8	1,633	21.9	3,300
1911	0	580	0	755	0	980	0	746	0	930
1912	39.9	2,330	26.1	2,165	34.1	2,340	26.0	2,734	35.1	2,340
1913	0	1,780	0	1,540	0	1,740	0	1,503	0	2,240
1914	15.5	2,060	3.9	1,458	8.5	1,600	3.2	1,156	27.9	2,130
Average	18.2	2,383	13.3	2,143	18.5	2,438	13.2	2,307	20.8	2,711
Value	$7.28	$4.77	$5.32	$4.29	$7.40	$4.88	$5.28	$4.61	$8.32	$5.42
Total value	$12.05		$9.61		$12.28		$9.89		$13.74	
Cost	7.49		7.49		7.11		7.11		12.36	
Profit	4.56		2.12		5.17		2.78		1.38	

From differences in crop sequence marked results have been obtained. Corn grown continuously on the same land has averaged about 5 bushels per acre more by both fall and spring plowing than when grown on small-grain stubble. The average increase in yield where corn follows corn as compared with corn following small grain is much greater in the grain than in the stover yields. Following sorghum there was a sharp decrease in yield. In rotations where corn followed oats on brome-grass and alfalfa sods the yield was considerably less than that obtained on similarly prepared land that had not been in sod.

Land that was summer tilled the previous year produced six good crops of grain in the eight years under study. In the other two years it did not produce sufficient grain to warrant husking. During the six years the average yield of grain was about 2 bushels more and the yield of fodder about 300 pounds more per acre by summer tillage than that produced by spring plowing corn ground, the next highest yielding method.

On spring-plowed corn ground the average value of the crop of grain alone has been more than sufficient to pay the cost of producing the crop. On fall-plowed corn ground the average value of the grain for eight years has lacked only 20 cents of paying the cost of production. All methods show a profit when a value is assigned to the stover or fodder. The profits per acre from the different methods have been as follows: Summer tillage, $1.38; fall plowing after small grain, $2.12; spring plowing after small grain, $2.78; fall plowing after corn, $4.56; and spring plowing after corn, $5.17.

AKRON FIELD STATION.

Table XIII presents the results of the work of six years in methods of production of corn at Akron, Colo. All methods have produced fodder every year. Summer-tilled land has produced a grain crop every year, its average yield for the entire period being 20.9 bushels of grain and 2,257 pounds of stover per acre. Other methods have met from one to three more or less complete failures of the grain crop. The average yield of corn after corn by both spring and fall plowing, however, has been practically the same as on summer-tilled land.

Corn after small grain was markedly poorer in yield of both grain and stover than corn following corn by either fall or spring plowing. Subsoiling the land where corn follows corn resulted in decreased yields every year as compared with fall plowing similar land without subsoiling it. Planting with the lister resulted in a still further decrease in yields.

The difference in the results following fall and spring plowing are negligible when the average of the whole series of years is considered. Fall and spring plowing of land where corn follows corn are the only methods that show a profit from the grain crop alone. When a value is assigned to the stover, all methods show profits ranging from 51 cents per acre on land which was summer tilled the previous year to $5.43 by spring plowing where corn followed corn.

TABLE XIII.—*Yields and cost of production of corn by different methods at the Akron Field Station, 1909 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Sub-soiled, after corn (1 plat).		Listed, after corn (2 plats).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (12 plats).		After corn (1 plat).		After small grain (9 plats).							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1909	27.3	3,890	24.6	2,424	30.0	4,700	23.5	2,499	32.8	4,300	26.1	4,325	25.0	3,190
1910	18.3	1,640	7.7	1,438	21.6	1,840	10.8	1,590	12.7	1,490	15.1	1,000	21.4	1,350
1911	0	1,040	5.4	1,378	1.3	1,210	.4	776	0	1,180	1.4	1,105	12.9	1,690
1912	46.9	3,040	30.0	2,393	33.9	2,500	31.0	2,303	37.1	2,440	22.0	2,060	33.6	2,500
1913	9.9	1,840	.5	1,010	13.6	2,020	4.3	1,476	4.3	1,290	9.0	1,530	13.7	2,410
1914	17.3	2,300	9.3	1,968	15.9	2,060	12.0	1,833	13.9	1,980	9.5	1,750	18.6	2,400
Average	20.0	2,292	12.9	1,769	19.4	2,388	13.7	1,746	16.8	2,113	13.9	1,962	20.9	2,257
Value	$8.00	$4.58	$5.16	$3.54	$7.76	$4.78	$5.48	$3.49	$6.72	$4.23	$5.56	$3.92	$8.36	$4.51
Total value	$12.58		$8.70		$12.54		$8.97		$10.95		$9.48		$12.87	
Cost	7.49		7.49		7.11		7.11		8.18		5.98		12.36	
Profit	5.09		1.21		5.43		1.86		2.77		3.50		.51	

HAYS FIELD STATION.

Table XIV presents some of the results of different methods of growing corn at Hays, Kans. The data are presented for only six years. In 1911 and 1913, for which no figures are given in the table, there would have been yields of forage, but the crop while suffering from drought was destroyed by grasshoppers. The area of the plats was so small that the damage from the insects was much worse than it would have been on larger fields. The surrounding area is cropped chiefly to small grains. When these are harvested, the grasshoppers move from the stubble into the corn and sorghums.

Corn produced an average of a little over 1½ tons of fodder and 5.5 to 9.9 bushels of grain per acre. Little difference is exhibited in the yields by different methods. Such differences as are shown are not consistent from year to year. While the crop is productive of a good amount of feed each year, it appears to offer little possibility as a grain crop. With values as here assigned to the grain and forage the crop shows a small profit from all methods except summer tillage, which is charged with an average loss of 54 cents per acre. The greatest profits were by listing after corn and by spring plowing after corn. These show average annual profits of $2.69 and $2.67 per acre, respectively.

TABLE XIV.—*Yields and cost of production of corn by different methods at the Hays Field Station, 1907 to 1914, inclusive.*[1]

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Subsoiled, after corn (1 plat).		Listed, after corn (1 plat).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (4 plats).		After corn (1 plat).		After small grain (10 plats).							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1907	12.2	6,820	4.1	6,543	13.1	6,950	4.4	5,684	13.6	6,660	7.8	6,790	9.5	6,850
1908	3.1	4,280	5.2	5,910	.9	5,520	6.4	5,133	8.8	5,065	7.4	4,200	14.8	6,965
1909	7.9	584	13.0	936	4.1	1,340	18.8	1,516	8.0	560	5.9	510	15.3	1,190
1910	6.8	2,950	6.9	2,768	11.0	2,900	6.6	2,609	7.4	3,205	6.1	2,210	8.4	2,900
1912	1.8	1,585	1.3	1,864	2.1	2,050	2.5	1,912	5.5	2,075	6.5	1,890	3.9	2,220
1914	5.5	3,135	2.7	3,050	5.2	3,245	2.4	2,888	6.4	3,350	3.6	2,960	7.4	3,450
Average	6.2	3,226	5.5	3,512	6.1	3,668	6.9	3,290	8.3	3,486	6.2	3,093	9.9	3,929
Value	$2.48	$6.45	$2.20	$7.02	$2.44	$7.34	$2.76	$6.58	$3.32	$6.97	$2.48	$6.19	$3.96	$7.86
Total value	$8.93		$9.22		$9.78		$9.34		$10.29		$8.67		$11.82	
Cost	7.49		7.49		7.11		7.11		8.18		5.98		12.36	
Profit or loss	1.44		1.73		2.67		2.23		2.11		2.69		— .54	

[1] The crops of 1911 and 1913 were so nearly destroyed by drought and insects that no yields were weighed.

GARDEN CITY FIELD STATION.

Table XV presents data on the production of corn by different methods at Garden City, Kans. Yields are presented for only four years. In both 1908 and 1910 there was a fair crop of fodder but weights were not obtained. In 1913 the crop was destroyed by a hailstorm on July 4.

TABLE XV.—*Yields and cost of production of corn by different methods at the Garden City Field Station in 1909 and 1911 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.		Spring plowed.		Subsoiled, after corn (1 plat).	Listed, after corn (2 plats).	Summer tilled. (1 plat).
	After corn (1 plat).	After small grain (11 plats).	After corn (1 plat).	After small grain (11 plats).			
Yields of stover:							
1909 pounds	....	2,972	....	3,446	....	2,180	....
1910 do	1,400	934	1,100	1,269	750	695	4,000
1912 do	4,620	4,498	5,580	3,935	4,500	5,570	5,780
1913 do	(1)	(1)	(1)	(1)	(1)	(1)	(1)
1914 [2] do	3,040	2,668	2,460	2,100	4,840	2,830	4,320
Average	3,020	2,768	3,047	2,688	3,363	2,819	4,700
Value	$6.04	$5.54	$6.09	$5.38	$6.73	$5.64	$9.40
Cost	7.49	7.49	7.11	7.11	8.18	5.98	12.36
Loss	−1.45	−1.95	−1.02	−1.73	−1.45	— .34	−2.96

[1] Destroyed by hail.

[2] The yield of grain was very small in 1914, and its weight was included with the stover.

No grain in sufficient quantity to husk was produced in any year by any of the methods under trial. The only material difference to be noted in the yields by different methods is the increased yield attending the growth of corn on land which was summer tilled the previous season. The method of summer tillage gave an average yield of 4,700 pounds of fodder per acre for the three years that weights were obtained. The crop produces a good amount of feed, but with the valuation and costs as here assigned it has been grown at small losses, ranging from 34 cents per acre by listing after corn to $2.96 on summer-tilled land.

DALHART FIELD STATION.

Table XVI presents data obtained in the growth of corn by different methods at Dalhart, Tex. The results of the work of six years are given. In three of the six years grain was produced by all methods.

TABLE XVI.—*Yields and cost of production of corn by different methods at the Dalhart Field Station, 1909 to 1914, inclusive.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Listed, after corn (1 plat).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (12 plats).		After corn (1 plat).		After small grain (7 plats).					
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1909	0	1,000	0	946	0	700	0	1,014	0	2,250	0	3,400
1910	8.6	3,160	9.2	2,947	15.1	3,610	15.3	2,914	25.6	3,340	25.6	4,110
1911	0	4,000	0	2,771	0	4,000	0	2,708	12.4	2,350	2.8	3,000
1912	7.4	2,250	14.1	2,779	10.5	2,200	9.7	2,751	21.0	3,100	23.0	3,300
1913	0	2,000	0	2,405	0	2,150	0	1,037	0	1,750	0	6,150
1914	35.6	3,855	20.3	3,566	31.5	3,690	17.0	3,255	25.1	2,740	30.8	3,440
Average	8.6	2,711	7.3	2,569	9.5	2,725	7.0	2,280	14.0	2,588	13.7	3,900
Value	$3.44	$5.42	$2.92	$5.14	$3.80	$5.45	$2.80	$4.56	$5.60	$5.18	$5.48	$7.80
Total value	$8.86		$8.06		$9.25		$7.36		$10.78		$13.28	
Cost	7.49		7.49		7.11		7.11		5.98		12.36	
Profit	1.37		.57		2.14		.25		4.80		.92	

The two heaviest yielding methods were summer tillage and listing after corn. Between the grain yields by these two methods there is little difference, but in the yield of fodder the summer tillage shows a marked superiority. Between the other methods little choice is to be made, although corn appears to yield slightly heavier after corn than after small grains and slightly heavier by spring plowing than by fall plowing. The crop was produced at a profit by all methods under trial. The net profits realized range from 25 cents per acre by spring plowing after small grain to $2.14 by spring plowing after corn and $4.80 by listing after corn.

AMARILLO FIELD STATION.

Table XVII presents the results in the growth of corn during seven years by different methods at Amarillo, Tex. No data are presented for 1910, as the station was moved and only one method was on trial that year. Fodder was produced each year by all methods, but in only one year was there a creditable production of grain.

Table XVII.—*Yields and cost of production of corn by different methods at the Amarillo Field Station, 1907 to 1914, inclusive, except 1910.*

Yields, values, etc. (average per acre).	Fall plowed.				Spring plowed.				Subsoiled, after corn (1 plat).		Listed, after corn (2 plats).		Summer tilled (1 plat).	
	After corn (1 plat).		After small grain (11 plats).		After corn (1 plat).		After small grain (3 plats).							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields:	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
1907	1.4	3,270	2.3	2,997	3.1	3,280	2.1	3,010	1.1	3,490	2.2	2,935	5.7	3,710
1908	22.9	4,580	19.8	3,107	20.3	3,300	14.7	2,863	25.7	3,810	24.7	2,390	27.6	3,700
1909	2.7	1,310	0	1,596	.6	560	0	1,383	1.7	990	5.4	1,043	6.4	1,890
1911	9.2	2,075	8.9	2,145	8.1	1,945	9.5	1,960	7.1	1,720	7.8	1,998	9.3	2,050
1912	.7	1,680	1.7	1,848	2.6	2,160	1.1	1,829	1.0	2,080	1.7	2,015	3.3	2,840
1913	0	380	0	773	0	700	0	383	0	430	0	225	0	1,750
1914	3.6	4,140	5.1	3,641	1.1	1,500	2.8	2,733	5.1	4,850	7.0	2,870	8.0	5,320
Average	5.8	2,491	5.4	2,301	5.1	1,921	4.3	2,023	6.0	2,481	7.0	1,925	8.6	3,037
Value	$2.32	$4.98	$2.16	$4.60	$2.04	$3.84	$1.72	$4.05	$2.40	$4.96	$2.80	$3.85	$3.44	$6.07
Total value	$7.30		$6.76		$5.88		$5.77		$7.36		$6.65		$9.51	
Cost	7.49		7.49		7.11		7.11		8.18		5.98		12.36	
Profit or loss	− .19		− .73		−1.23		−1.34		− .82		.67		−2.85	

The yields by different methods show comparatively small differences. Summer tillage shows a small increase in yield of both grain and stover over all other methods of preparations. Fall plowing was a somewhat better preparation than either spring plowing or listing. Subsoiling failed to increase yields over fall plowing similar land without subsoiling. Listing shows a small profit of 67 cents per acre. All other methods show losses ranging from 19 cents per acre by fall plowing after corn to $2.85 on summer-tilled land.

GENERAL DISCUSSION OF RESULTS.

In the foregoing pages the results of growing corn by different methods of land preparation have been discussed in more or less detail for each individual station. It yet remains to take a broader view of the problem, and the relative merits of different methods will be considered for the Great Plains area as a whole. Some comparisons of station with station as representatives of different sections of country whose results are indicative of the comparative value of corn to such sections will also be made.

For this study, Table XVIII has been compiled from the data given in Tables V to XVII, inclusive. The average yields of corn by each method and the profits or losses attending the use of each method, as shown in the detail tables for the several stations, are here assembled.

TABLE XVIII.—*Comparison of the average yields and profit or loss in the production of corn by different methods at thirteen field stations in the Great Plains area.*

Statement of data.	Methods of tillage.													
	Fall plowed.				Spring plowed.				Subsoiled, after corn.		Listed, after corn.		Summer tilled.	
	After corn.		After small grain.		After corn.		After small grain.							
	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.	Grain.	Stover.
Yields per acre:	*Bu*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*	*Bu.*	*Lbs.*
Judith Basin	.....	5,744	.....	5,275	.....	6,002	.....	5,193	.....	6,130	.....	5,982	.....	5,656
Huntley	14.0	1,380	19.4	1,497	21.8	1,375	25.2	1,654	19.8	1,945	26.3	1,605	26.1	1,695
Williston	15.3	5,542	12.8	7,143	15.1	5,780	14.1	6,537	.....	.....	.....	.....	17.6	5,924
Dickinson	19.9	2,105	20.6	2,144	21.5	2,362	19.8	2,408	.....	.....	.....	.....	14.5	1,822
Edgeley	7.0	3,039	8.2	3,201	7.3	3,129	8.4	3,245	.....	.....	.....	.....	6.8	2,926
Belle Fourche	10.0	2,288	8.1	1,655	9.8	2,145	7.8	1,742	9.4	2,125	10.3	2,129	17.0	2,178
Scottsbluff	30.1	1,753	24.5	2,516	27.9	1,913	27.5	2,770	26.8	2,280	24.9	1,740	39.0	3,200
North Platte	18.2	2,383	13.3	2,143	18.5	2,438	13.2	2,307	.....	.....	.....	.....	20.8	2,711
Akron	20.0	2,292	12.9	1,769	19.4	2,388	13.7	1,746	16.8	2,113	13.9	1,962	20.9	2,257
Hays	6.2	3,226	5.5	3,512	6.1	3,668	6.9	3,290	8.3	3,486	6.2	3,093	9.9	3,929
Garden City	.....	3,020	.....	2,768	.....	3,047	.....	2,688	.....	3,363	.....	2,819	.....	4,700
Dalhart	8.6	2,711	7.3	2,569	9.5	2,755	7.0	2,280	.....	.....	14.0	2,588	13.7	3,900
Amarillo	5.8	2,491	5.4	2,301	5.1	1,921	4.3	2,023	6.0	2,481	7.0	1,925	8.6	3,037
Average	12.9	2,922	11.5	2,961	13.5	2,915	12.1	2,914	.....	.....	.....	.....	16.2	3,380
Profit or loss (—) per acre:														
Judith Basin	$4.00		$3.06		$4.89		$3.28		$4.08		$5.98		$—1.05	
Huntley	.87		3.26		4.36		6.28		3.63		7.75		1.47	
Williston	9.71		11.92		10.49		11.60		....		....		6.53	
Dickinson	4.68		5.04		6.21		5.63		....		....		—2.92	
Edgeley	1.38		2.19		2.07		2.74		....		....		—3.79	
Belle Fourche	1.09		— .94		1.10		— .51		— .17		2.40		—1.20	
Scottsbluff	8.06		7.34		7.88		9.43		7.10		7.46		9.64	
North Platte	4.56		2.12		5.17		2.78		....		....		1.38	
Akron	5.09		1.21		5.43		1.86		2.77		3.50		.51	
Hays	1.44		1.73		2.67		2.23		2.11		2.69		— .54	
Garden City	—1.45		—1.95		—1.02		—1.73		—1.45		— .34		—2.96	
Dalhart	1.37		.57		2.14		.25		....		4.80		.92	
Amarillo	— .19		— .73		—1.23		—1.34		— .82		.67		—2.85	

Three series of graphs (figs. 4, 5, and 6) are also presented. Figure 4, prepared from a part of the data in Table XVII, shows in graphic form the average yields of grain in bushels per acre at each station for each of the five methods studied that have been under trial at all of the stations. The Judith Basin Field Station is not shown in this figure for the reason that grain was neither produced nor expected at that station in this work. Garden City is also omitted because the grain there produced was insufficient to warrant husking.

Figure 5 is a graphic presentation of the yields of stover as shown in Table XVIII. Like figure 4, it includes only the five methods that have been under trial at all stations.

Figure 6, prepared from Table VIII, shows graphically the average relative profit or loss attending the use of each of the five methods at each of the stations.

Table XVIII, illustrated in part in figure 4, shows that during the years covered by this work creditable average yields of grain have been obtained by all methods at Huntley, Williston, Dickinson, Scottsbluff, North Platte, and Akron, and by one method at Belle Fourche and Dalhart. No grain has been produced either at the Judith Basin Field Station or at Garden City.

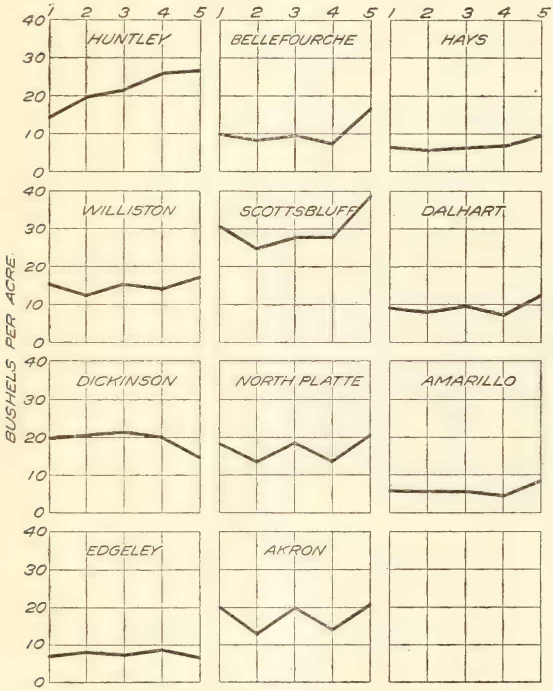

FIG. 4.—Graphs showing the average yields of corn in bushels per acre by different methods at eleven field stations in the Great Plains area. The methods of tillage are indicated by Arabic numerals at the top, as follows: *1*, Fall plowing after corn; *2*, fall plowing after small grain; *3*, spring plowing after corn; *4*, spring plowing after small grain; *5*, summer tillage. The field stations of Judith Basin and Garden City do not appear, because the corn grown at these stations produced no grain.

Little difference is shown in the average yields of grain by the different cultural methods in use at Williston, Edgeley, Hays, and Amarillo. At Dickinson, Belle Fourche, and Dalhart the only method of preparation giving yields departing far from the others has been that of summer tillage. At Dickinson summer tillage has been responsible for a decrease in yields and at Belle Fourche and Dalhart for an increase.

Between the yields following fall and spring plowing little general difference is to be noted, except that at Huntley fall plowing has been better than spring plowing, and at Scottsbluff fall plowing after corn has been better and fall plowing after small grains poorer than spring plowing after either. At some stations more difference is to be noted as a result of crop sequence than as a result of difference in time of plowing. At Huntley corn has been better after small grain than after corn. At both North Platte and Akron corn after corn by both fall and spring plowing has been markedly better than corn after small grain.

Figure 5 presents the average yields of fodder at each of the stations. The results by each of the five methods that have been under trial at all stations are shown separately.

It appears that the yields reported from the Judith Basin Field Station and from Williston are abnormally high. While the yields have generally been good at these stations, it is doubtful if they have been as much higher than those at some of the other stations, as these figures indicate. It is probable that in the years showing excessively high yields the crop has not been well dried at the time of weighing.

A very striking fact brought out by this graphic showing is the uniformity in the amount of stover or fodder produced by all methods at the stations in Montana and North Dakota. So far as the production of rough feed is concerned, there appears very little difference on which to base a choice. South of North Dakota there is a general agreement of heavier yields of stover or fodder after corn than after small grain, except that at Scottsbluff the yields are heavier after small grain than after corn.

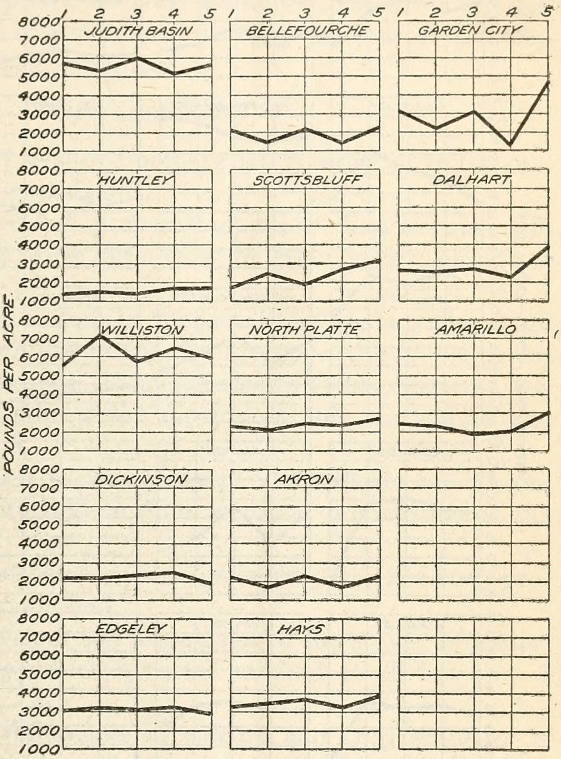

FIG. 5.—Graphs showing the average yields of corn stover in pounds per acre by different methods at thirteen field stations in the Great Plains area. The methods of tillage are indicated by Arabic numerals at the top, as follows: *1*, Fall plowing after corn; *2*, fall plowing after small grain; *3*, spring plowing after corn; *4*, spring plowing after small grain; *5*, summer tillage.

Small differences in stover yields are to be noted between the results following spring and fall plowing. On the whole, the average yields by the two methods are almost the same.

The most noticeable effect resulting from cultural practice is the very marked increase in the yield of stover resulting from growing corn on summer-tilled land at the more southern stations—Garden City, Dalhart, and Amarillo. Only small increases in yields have attended the use of this method at Scottsbluff, North Platte, and Hays.

Subsoiling has not markedly affected the yields, except that at Akron it has decreased them.

Listing has materially increased the yields at Huntley and at Dalhart. At the other stations the effect has not been marked.

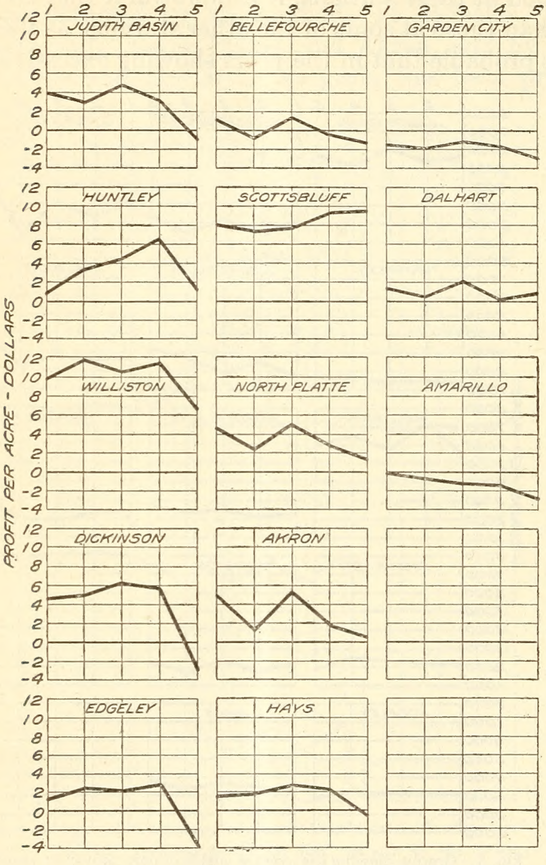

FIG. 6.—Graphs showing the average profit or loss in dollars per acre by different methods at thirteen field stations in the Great Plains area. The methods of tillage are indicated by Arabic numerals at the top, as follows: *1*, Fall plowing after corn; *2*, fall plowing after small grain; *3*, spring plowing after corn; *4*, spring plowing after small grain; *5*, summer tillage.

The last half of Table XVIII, illustrated in part in figure 6, presents the average relative profits and losses attending the growth of corn by different methods at each of the stations. It shows corn to be relatively much less profitable at Belle Fourche, Garden City, Dalhart, and Amarillo than at the other stations.

Scottsbluff is the only station where summer tillage as a preparation for corn has proved the most profitable method. At most of the stations this method has been the least profitable. Its use has resulted in actual loss at the stations of Judith Basin, Dickinson, Edgeley, Belle Fourche, Hays, Garden City, and Amarillo.

It is shown very clearly in figure 6 that greater profit has been realized from corn after corn than from corn after small grain at Akron and North Platte. At Huntley, corn after small grain has been more profitable.

Listing has been tried at nine stations. Except at Scottsbluff and Akron, it has been the most profitable method under trial. As has been pointed out, the relative profitableness of this method has been largely due to its low cost.

A careful reading of the data given in the table will show that corn as a grain or cash crop can not be profitably grown in large portions of the Great Plains. At only 5 of the 13 stations have the grain yields been sufficiently large to indicate a possibility of the crop being profitably produced for the grain only. At Huntley, Dickinson, Scottsbluff, North Platte, and Akron enough grain was produced by some methods to pay the cost of production and show small profits. Taken as a whole, however, the data show that, in order to realize the full profit, the corn should be considered as a feed crop. To pay the cost of production in many sections, it is necessary to utilize the roughage produced.

CONCLUSIONS.

(1) No one method of seed-bed preparation is essential to the production of corn in the Great Plains.

(2) Differences in seed-bed preparation, other than summer tillage, have not produced wide differences in grain yields, except at Huntley, Mont.

(3) Summer tillage has slightly increased the grain yield at all except three stations and has materially increased the fodder yields at the three southern stations. The increase in yields, however, has not been sufficient to make it the most profitable method at any station except Scottsbluff.

(4) At some of the stations, especially at North Platte and Akron, crop sequence is more important than seed-bed preparation in the production of corn.

(5) At 8 of the 13 stations corn as a grain crop has not been produced at a profit by any method.

(6) When a value of $4 per ton is assigned to the stover or fodder, corn has been profitably grown by some method at all but one of the stations.

(7) The response to differences in culture and crop sequence is greater in the southern and central portion of the Great Plains than it is in the northern portion.

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